Clear Sky OLR and Surface Skin Temperature from GMAO-GEOS4 and ECMWF Analyses

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Outline

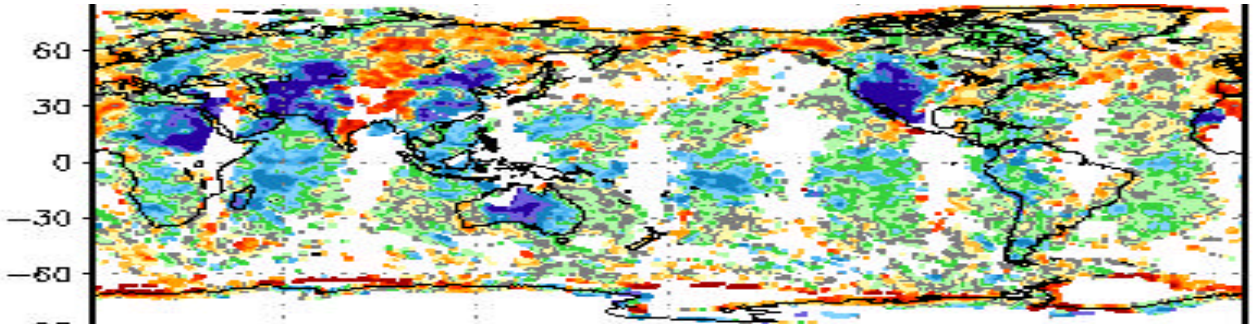
- **CERES concerns on earlier GEOS4 Tskin analyses.**
- Improvements in latest GMAO system.
  New LSM , Tskin Analysis, etc.
- **New Results:**
  GMAO Tskin is comparable to that of the ECMWF.

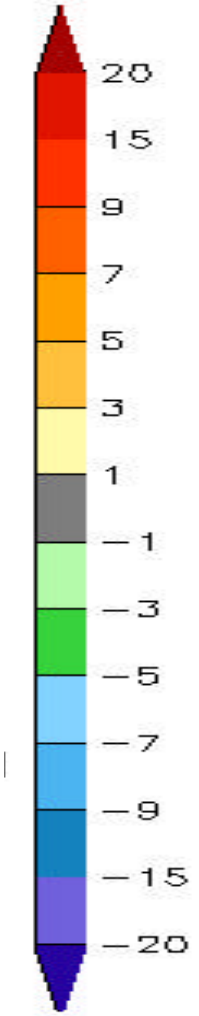
CLR MAY 2001

OLD GEOS4 minus CERES Observed

W/m²

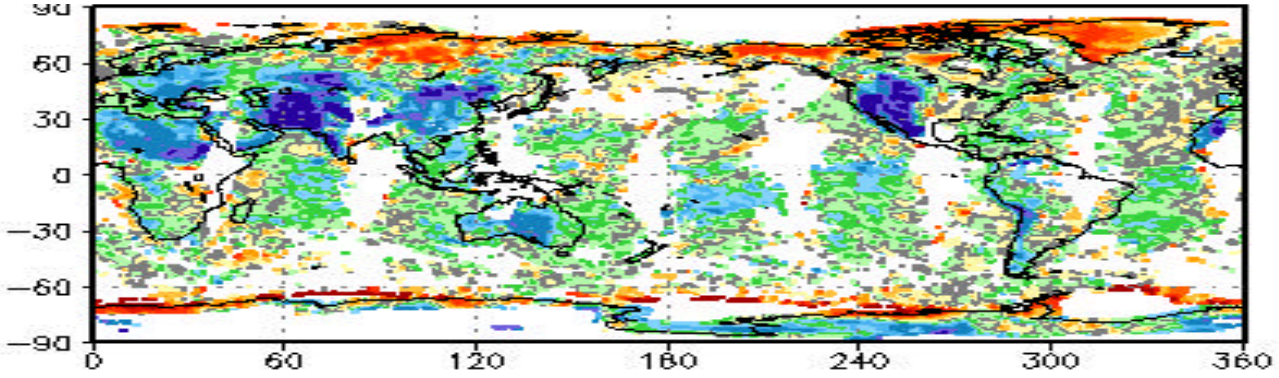
BIAS =-1.9
RMS = 8





ECMWF minus CERES Observed

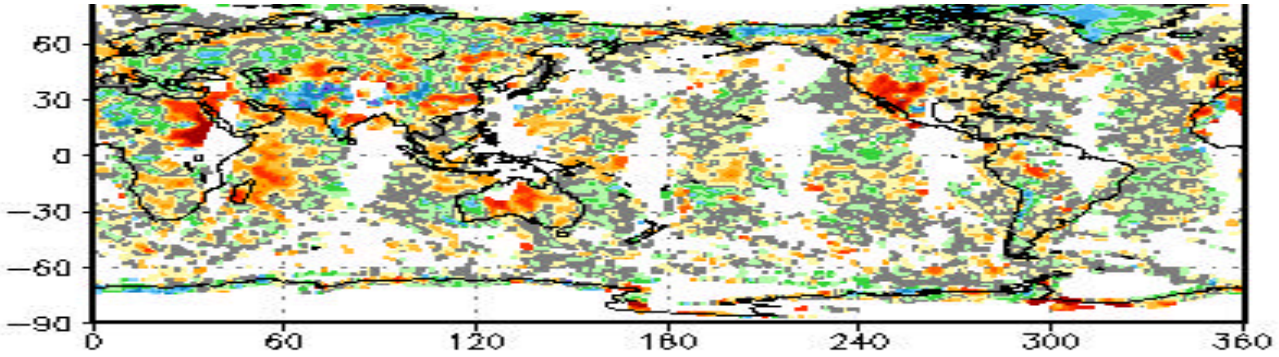
BIAS =-2
RMS = 7



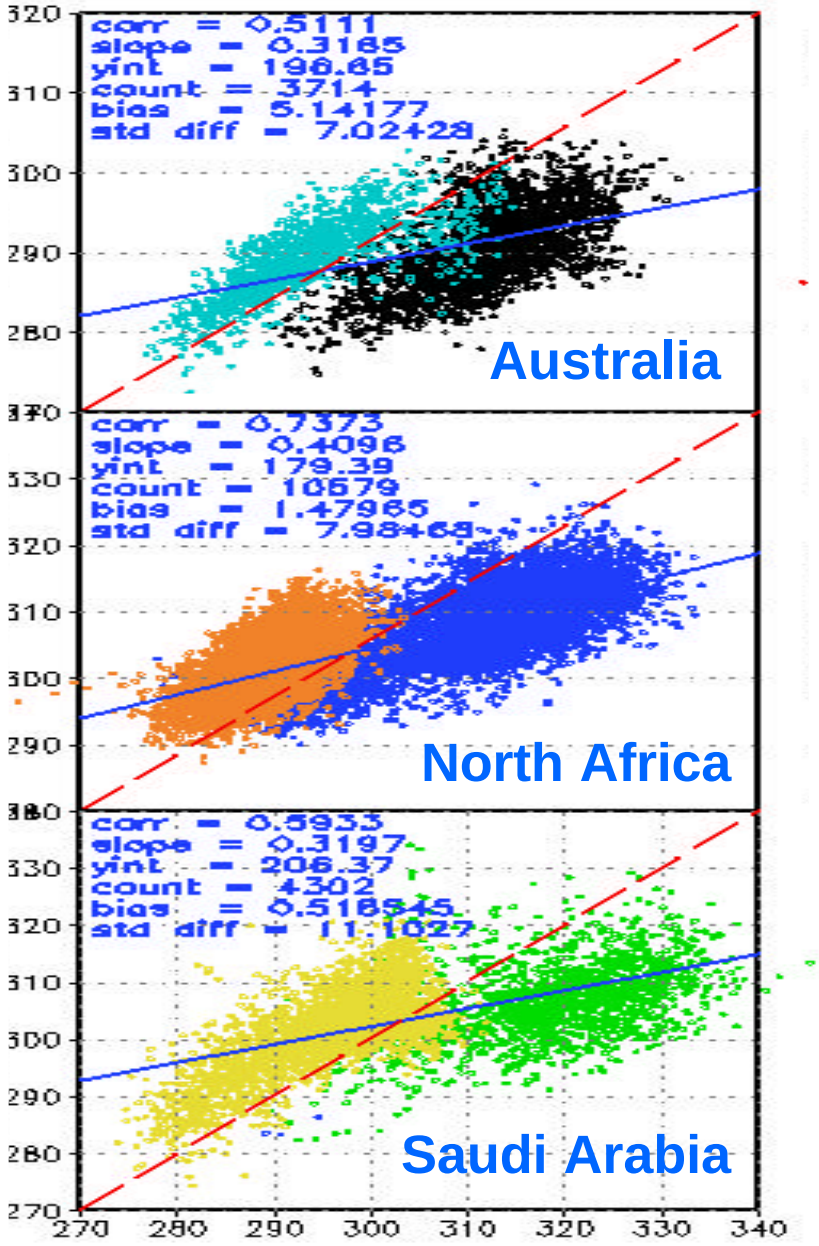
OLD GEOS4 Error minus ECMWF Error

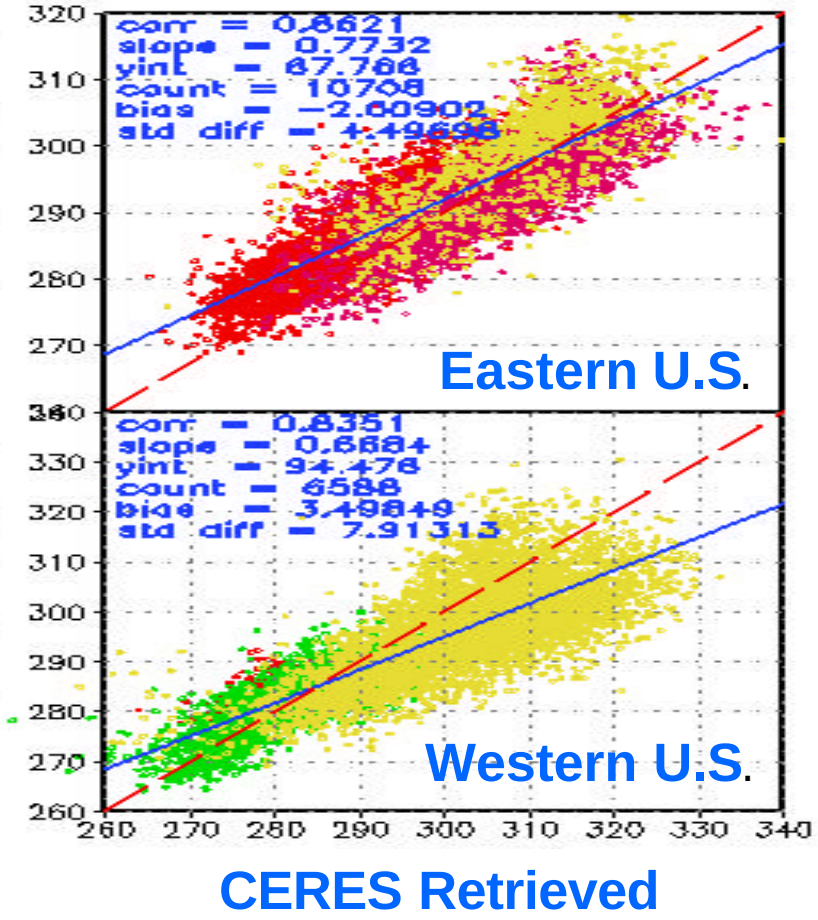
Warm colors=>
ECMWF better

Cold colors=>
GEOS4 better

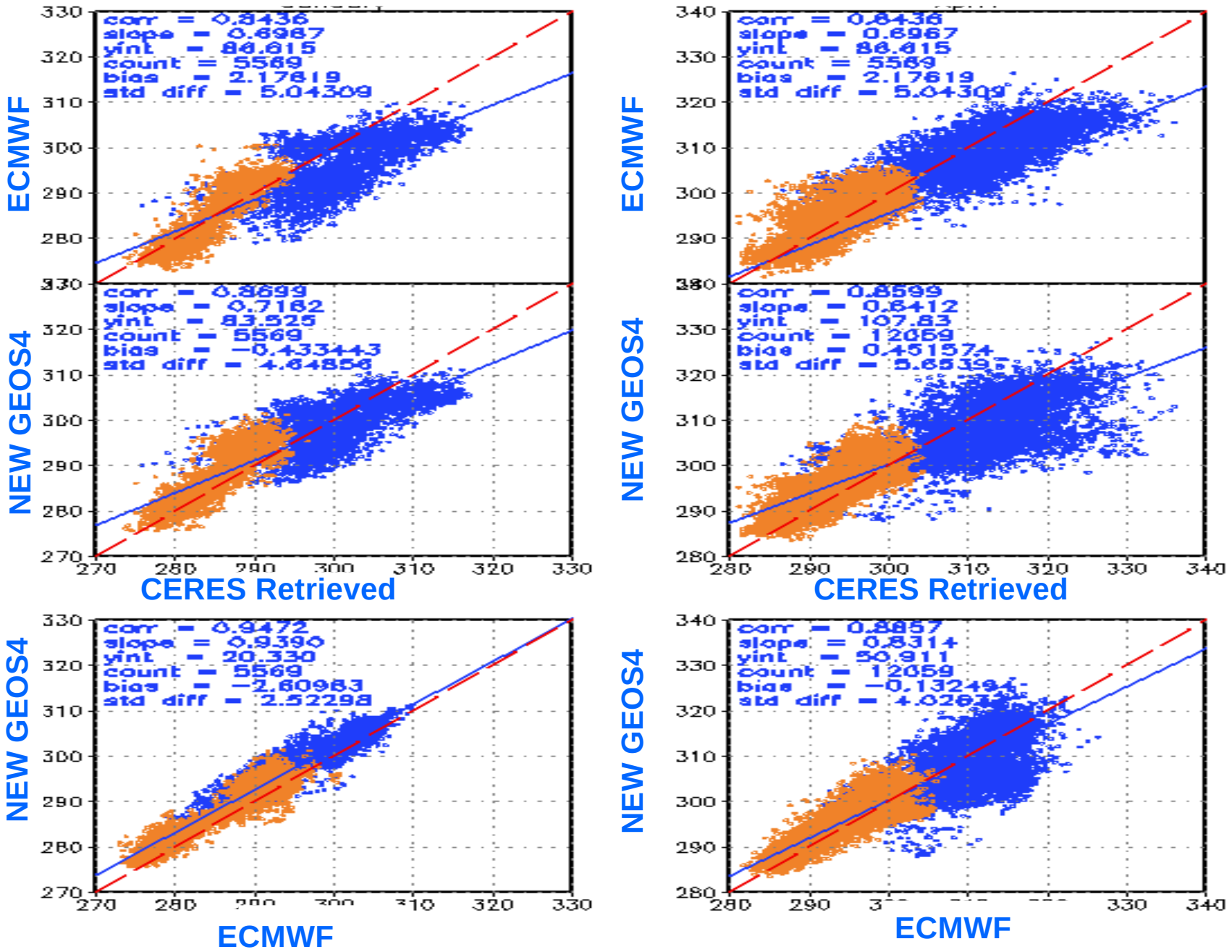


Tskin – OLD GEOS4 vs CERES

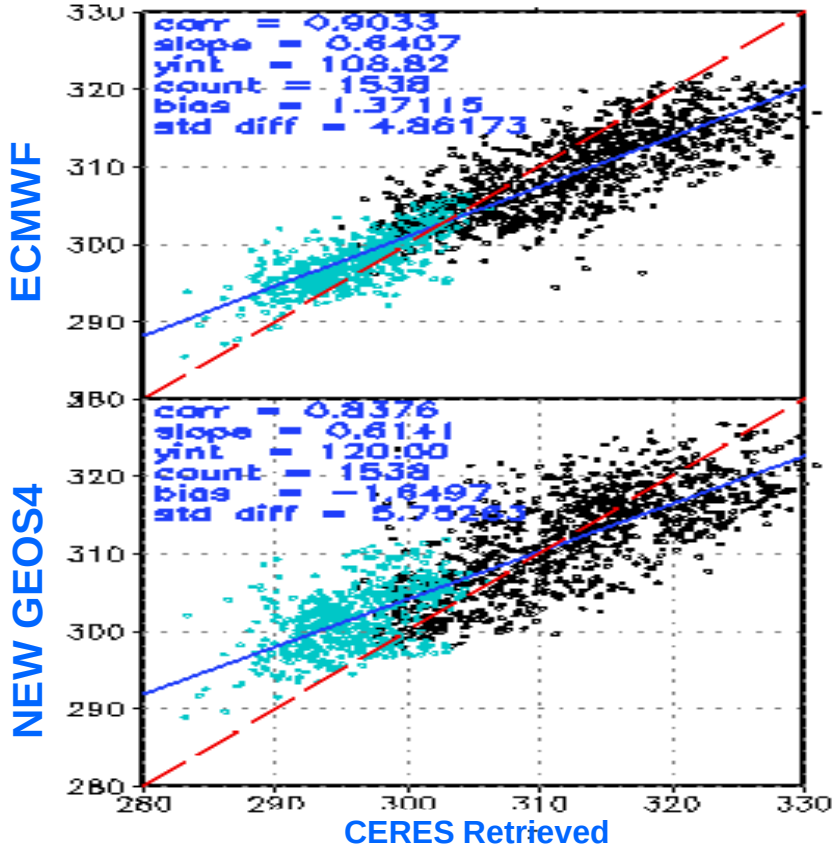


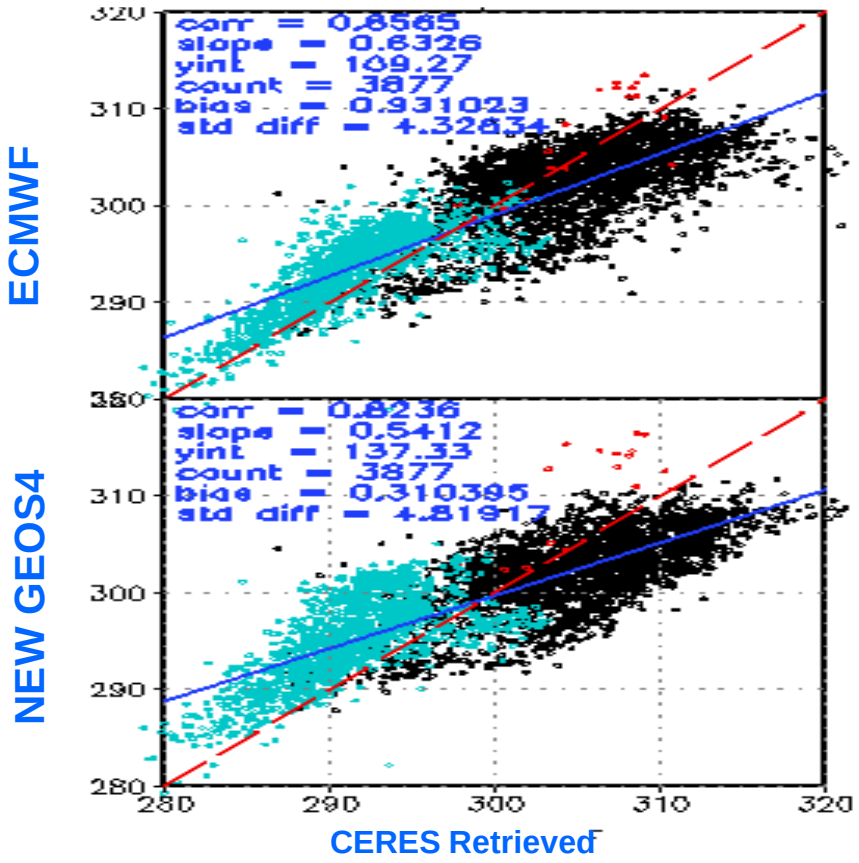


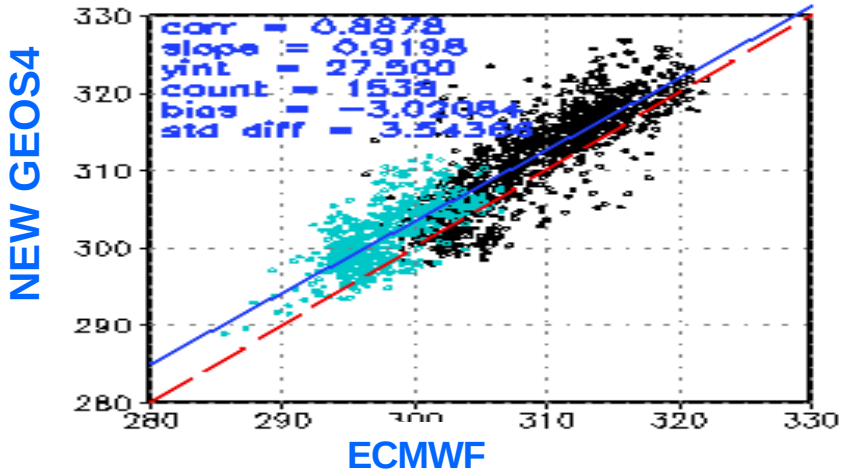
Tskin -- North Africa

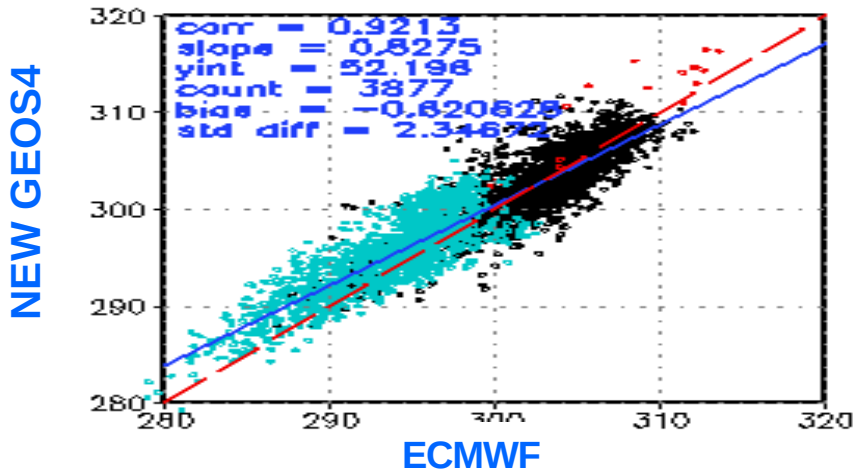


JANUARY Tskin -- Australia APRIL





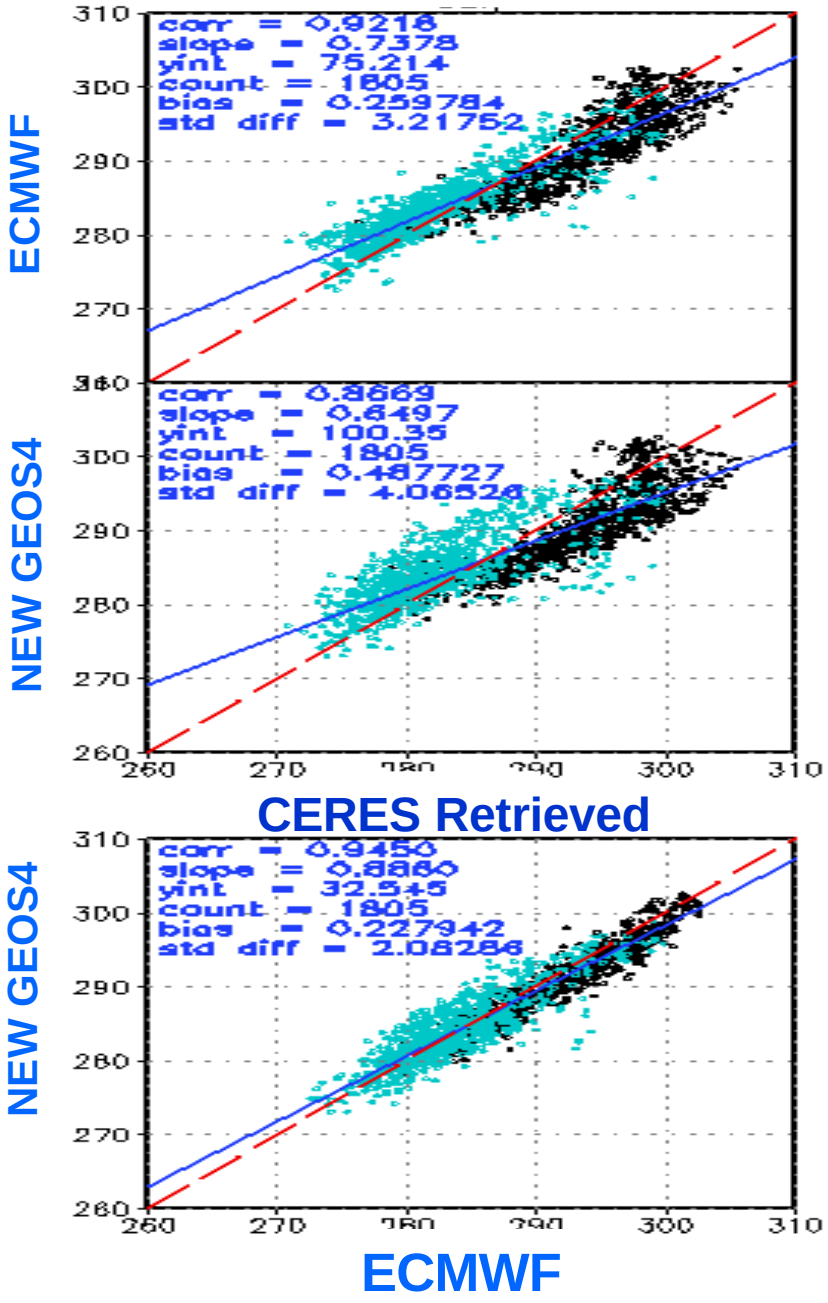


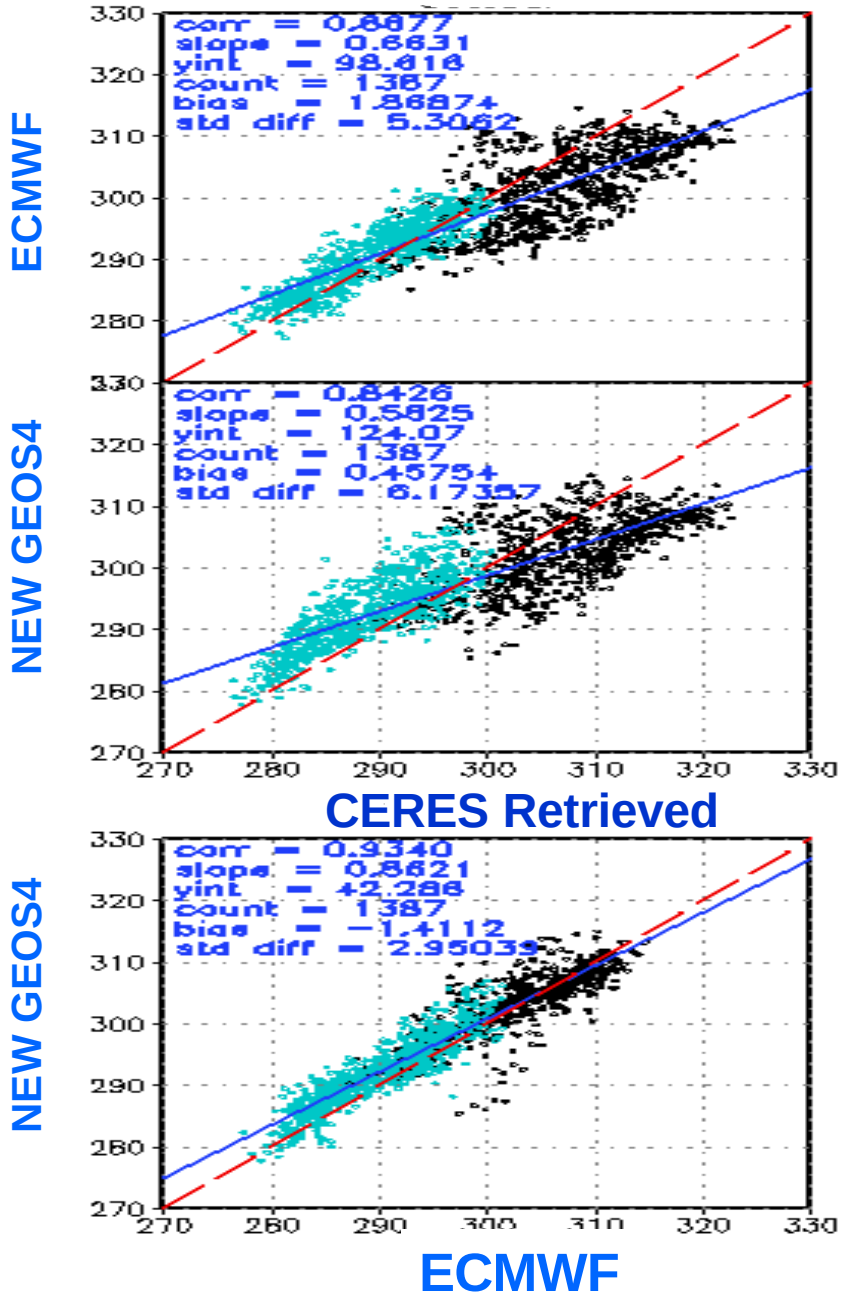


July

Tskin -- North Africa

October

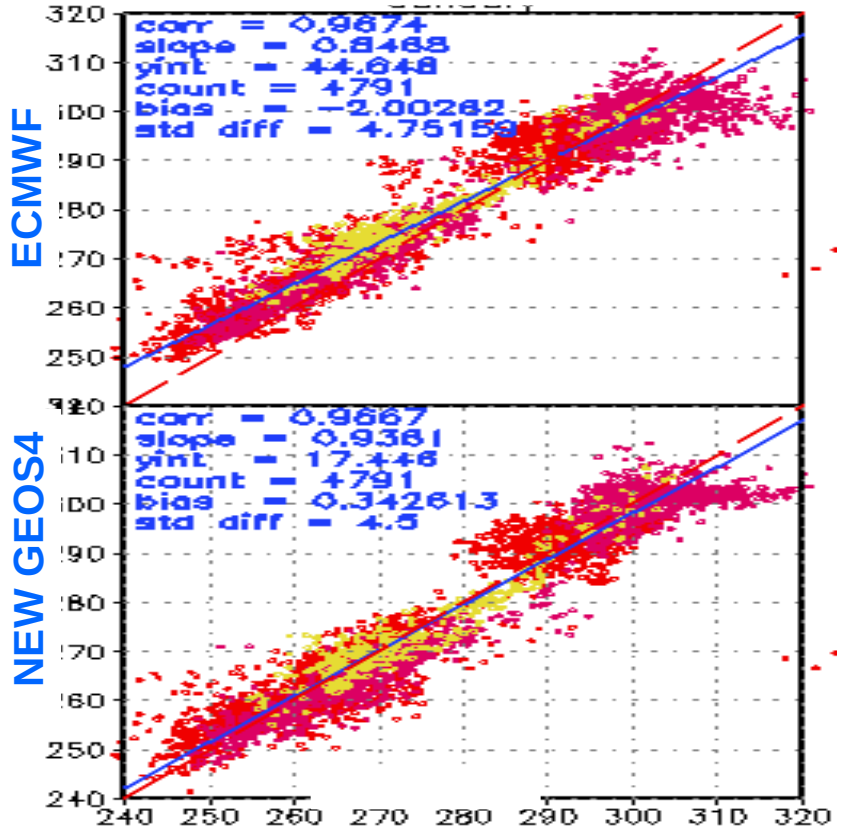


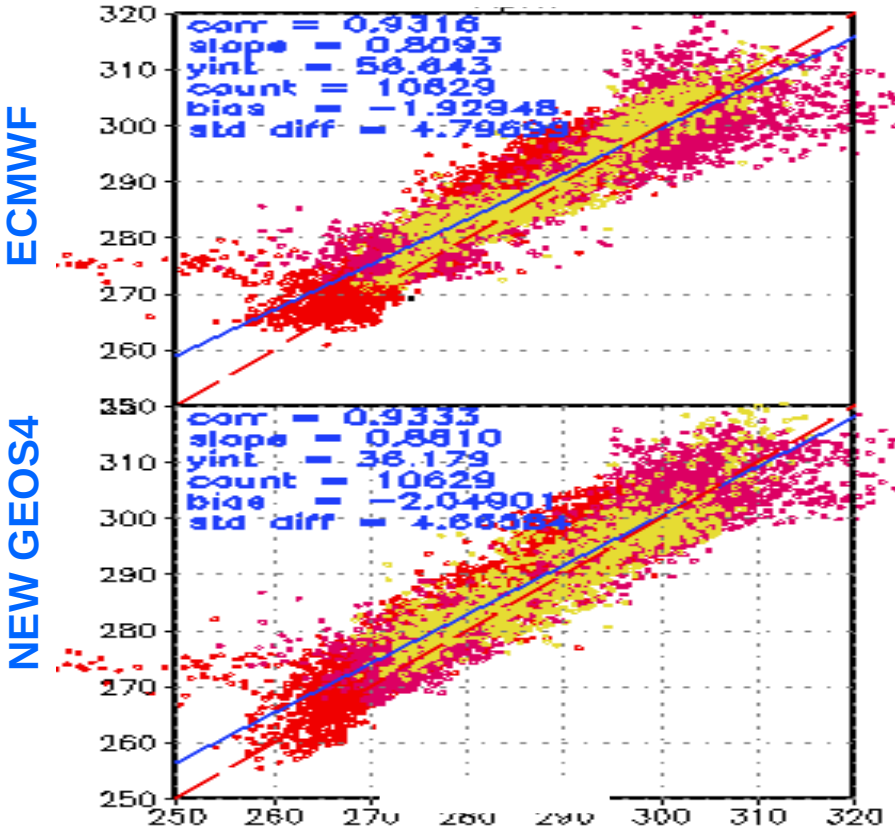


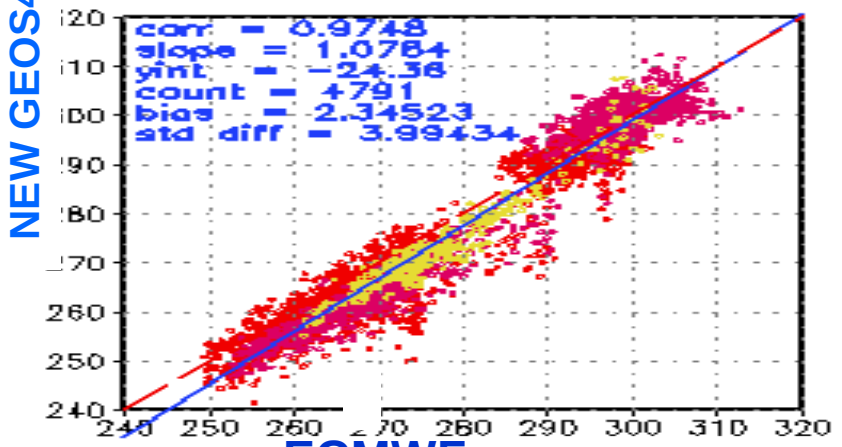
JANUARY

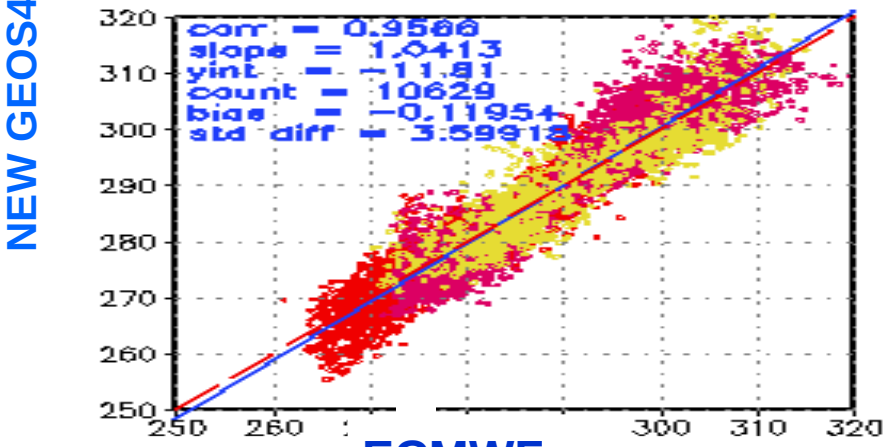
Tskin -- Western U.S.

APRIL





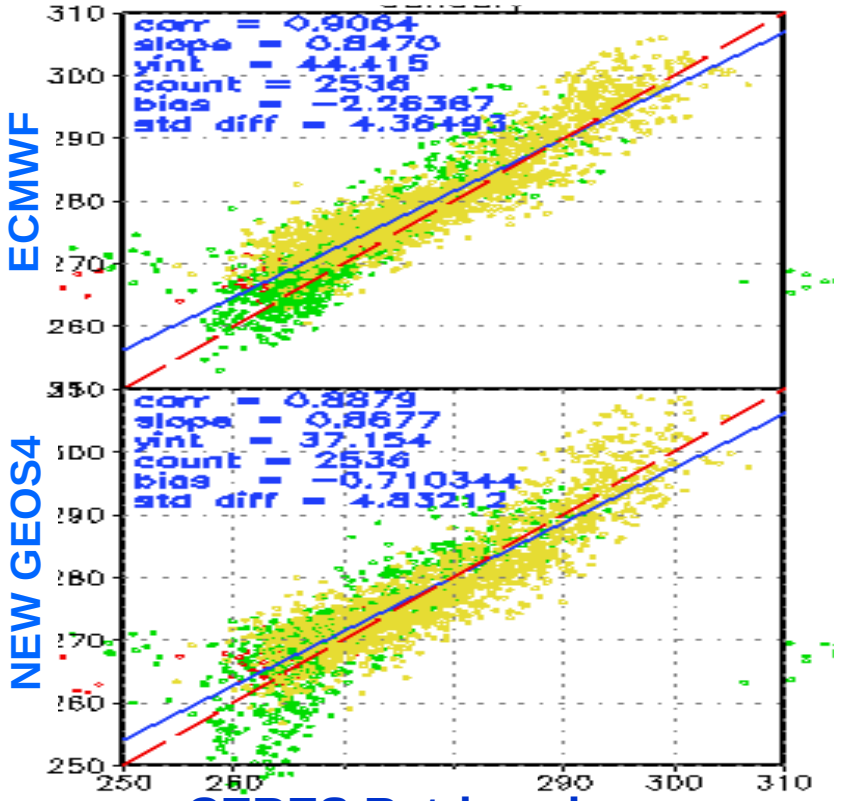


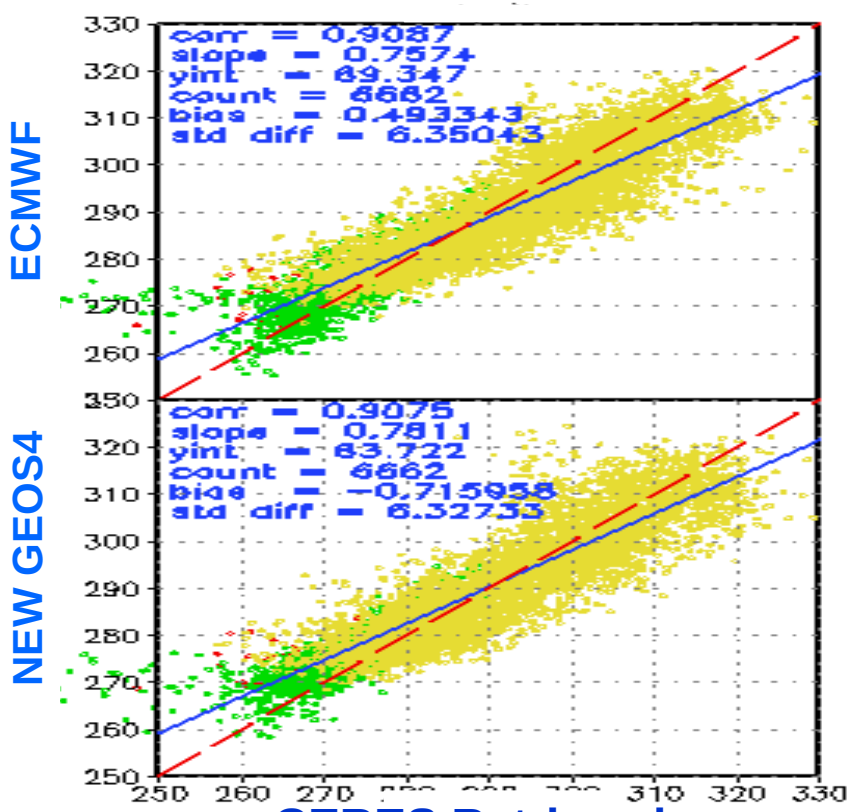


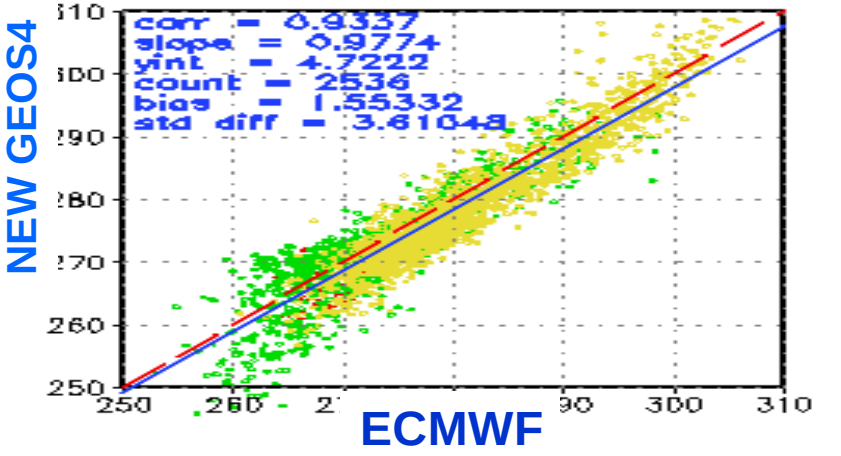
JANUARY

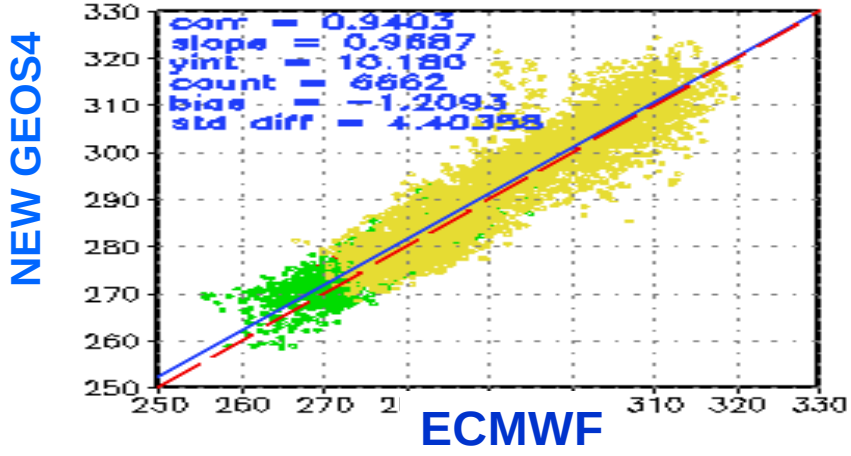
Tskin -- Eastern U.S.

APRIL





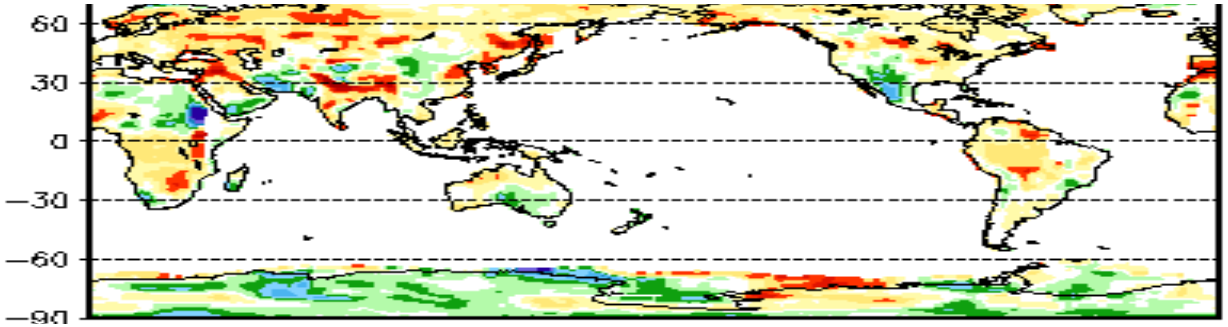


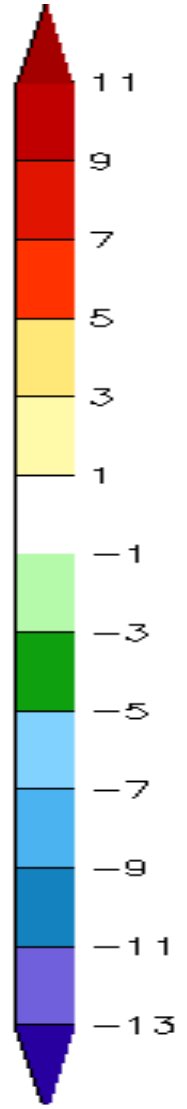


Tskin April 2001

NEW GEOS4 minus CERES Observed

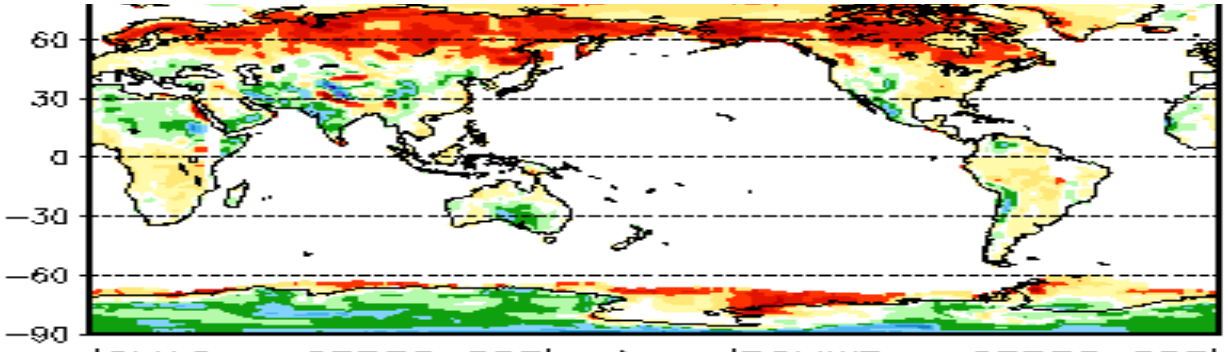
BIAS =1.5
RMS = 3.4





ECMWF minus CERES Observed

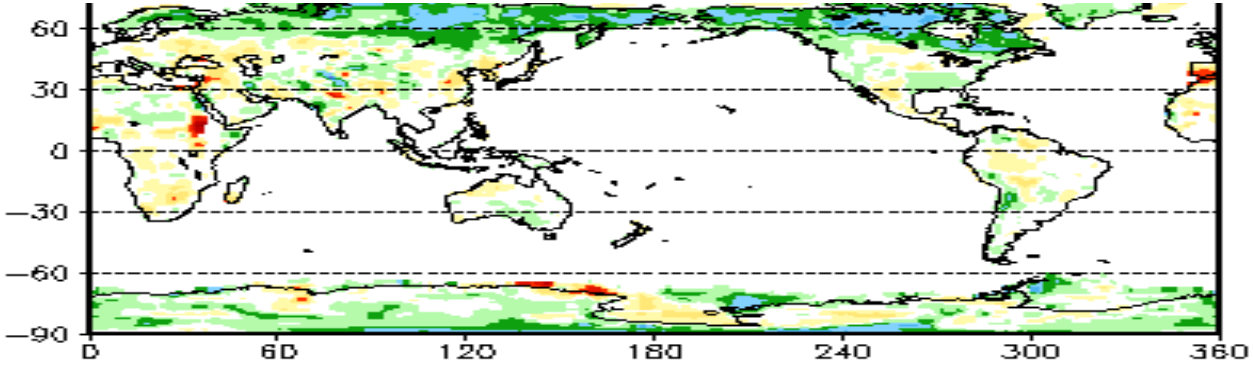
BIAS = 1.4
RMS = 4.0



NEW GEOS4 Error minus ECMWF Error

Warm colors=>
ECMWF better

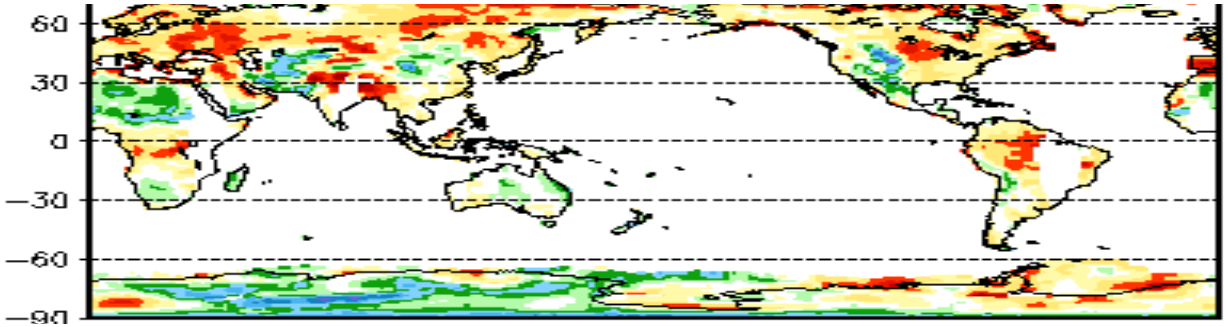
Cold colors=>
GEOS4 better



Tskin July 2001

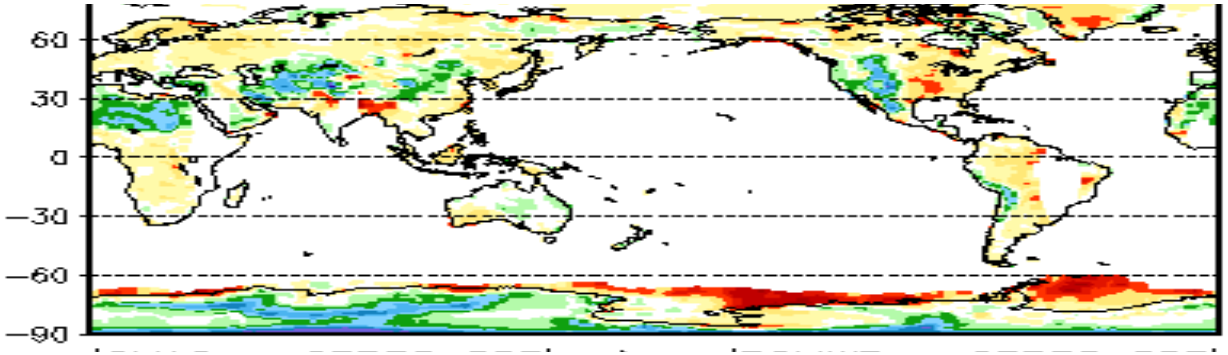
NEW GEOS4 minus CERES Observed

BIAS =0.7
RMS = 3.6



ECMWF minus CERES Observed

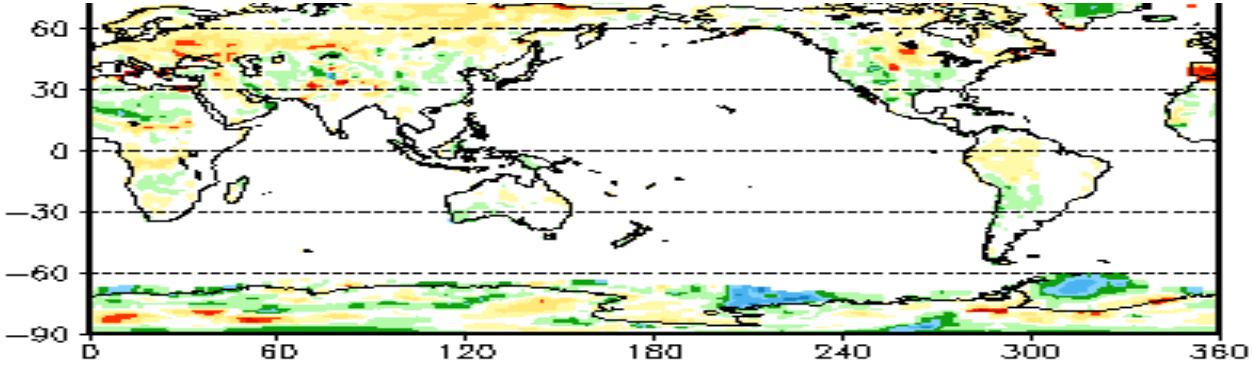
BIAS = 0.2
RMS = 3.9

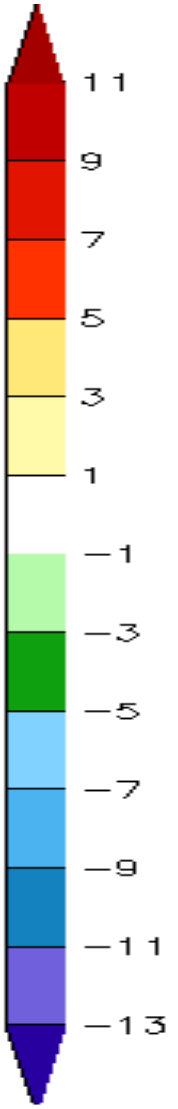


NEW GEOS4 Error minus ECMWF Error

Warm colors=>
ECMWF better

Cold colors=>
GEOS4 better

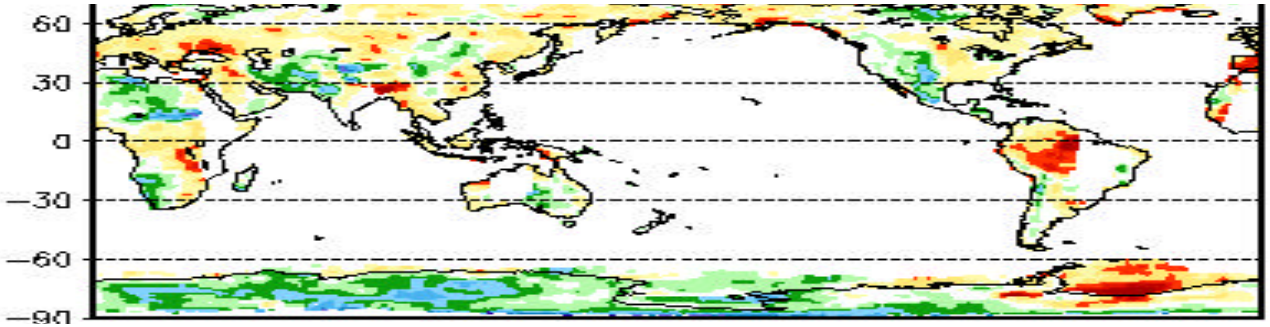




Tskin October 2001

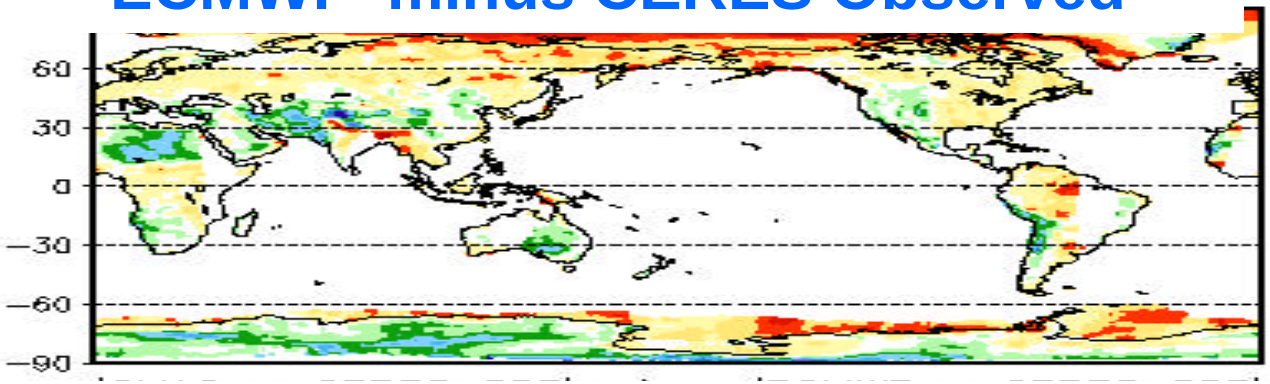
NEW GEOS4 minus CERES Observed

BIAS =1.0
RMS = 3.4



ECMWF minus CERES Observed

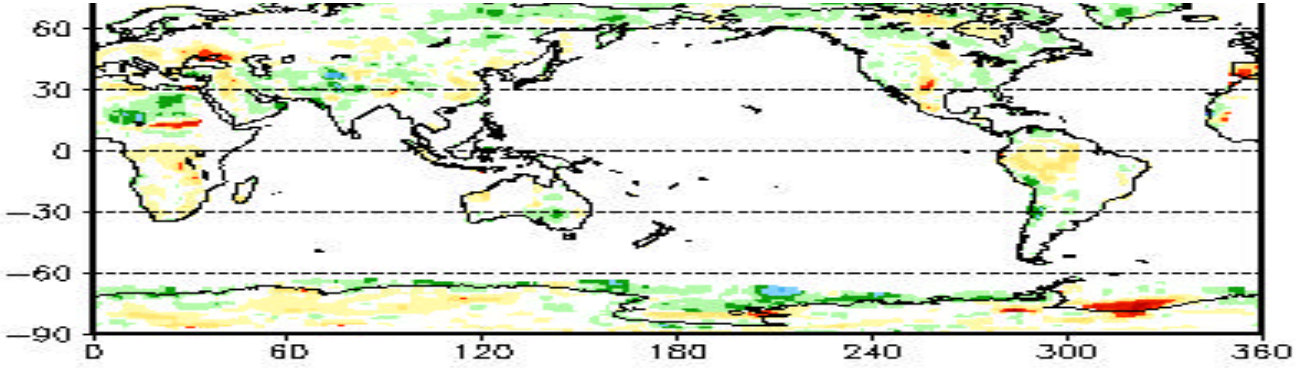
BIAS = 1.7
RMS = 3.6

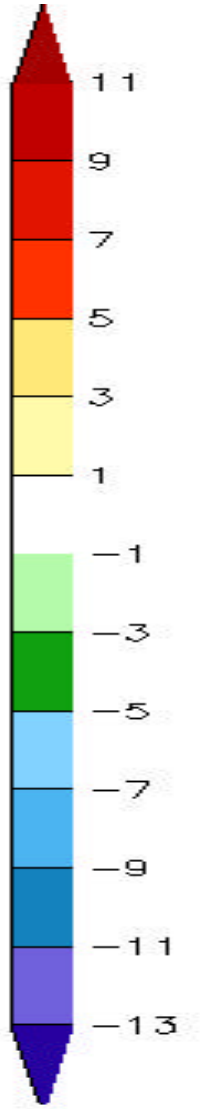


NEW GEOS4 Error minus ECMWF Error

Warm colors=>
ECMWF better

Cold colors=>
GEOS4 better

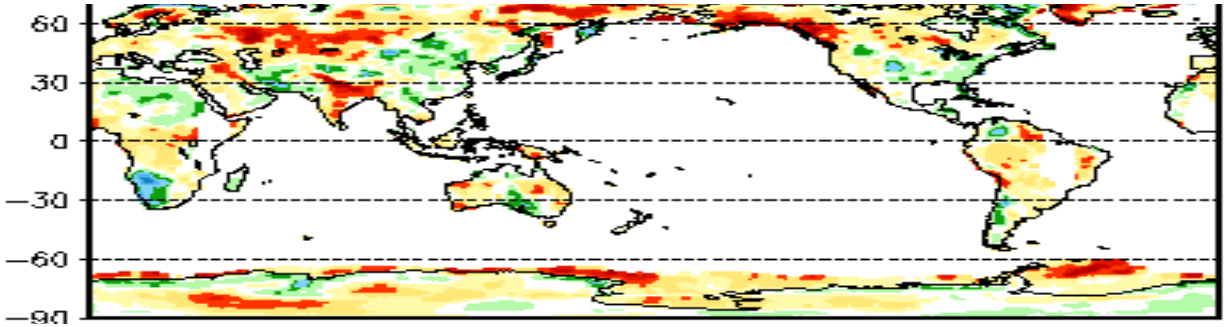


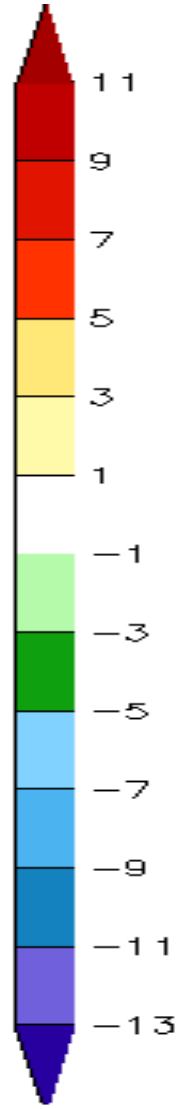


Tskin January 2001

NEW GEOS4 minus CERES Observed

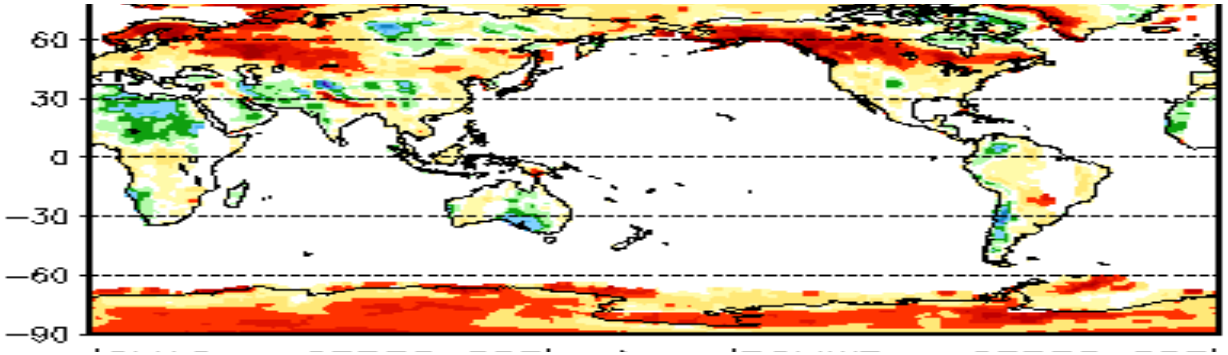
BIAS =2.2
RMS = 3.4





ECMWF minus CERES Observed

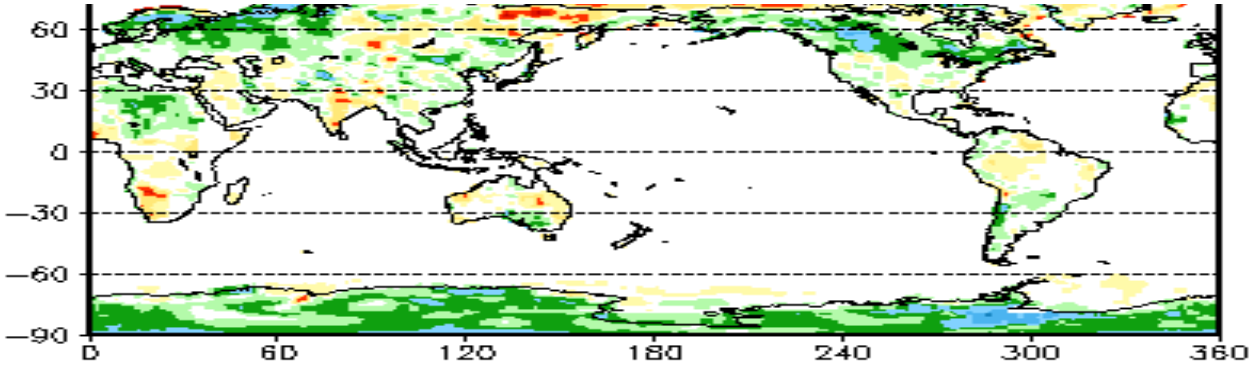
BIAS = 3.2
RMS = 3.4



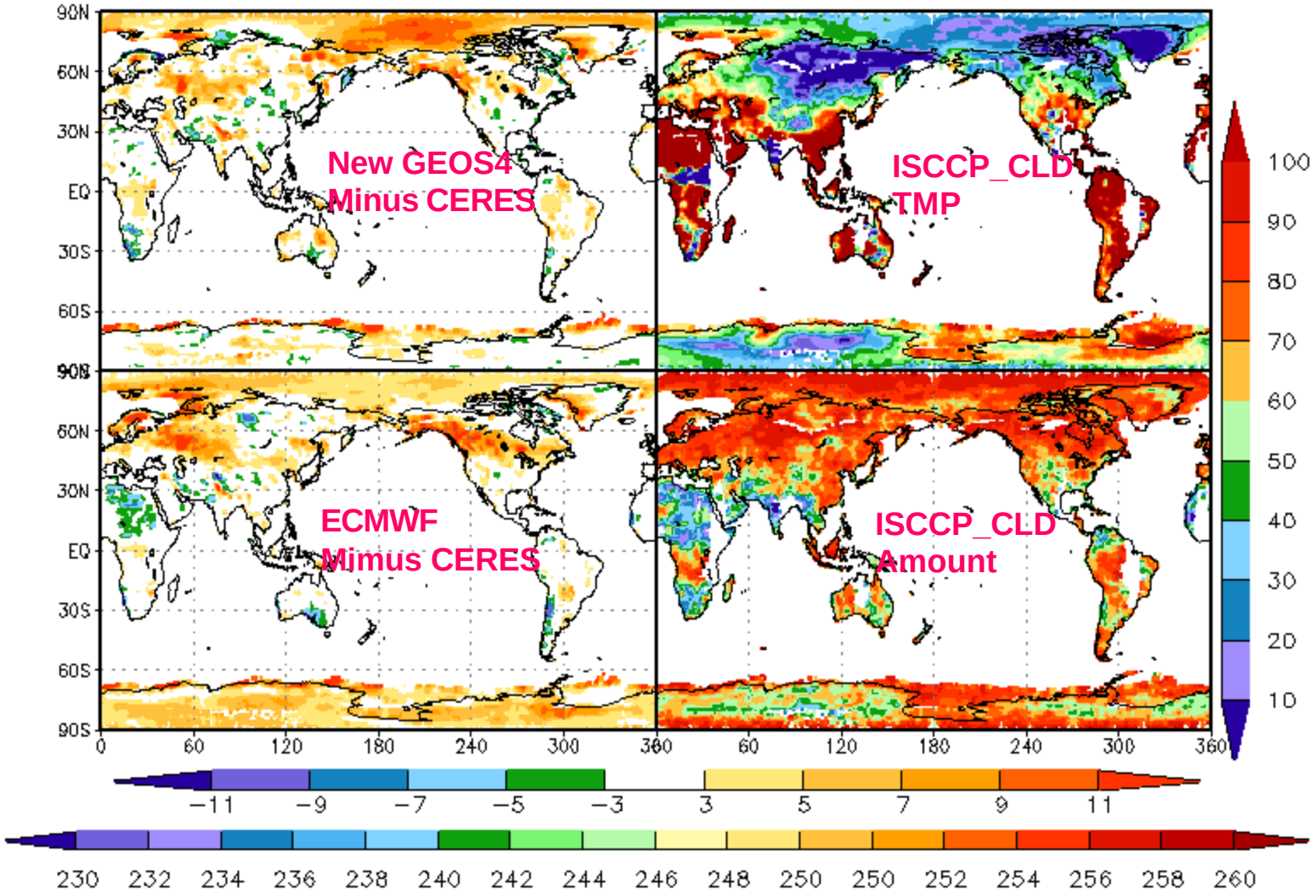
NEW GEOS4 Error minus ECMWF Error

Warm colors=>
ECMWF better

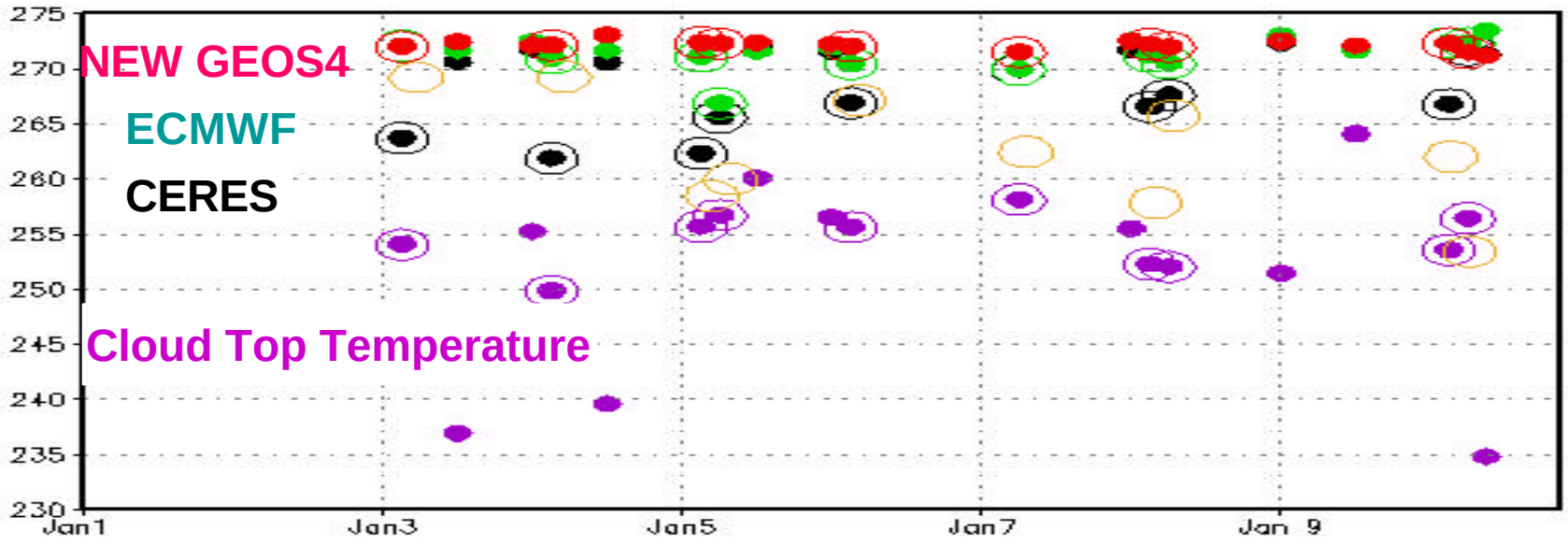
Cold colors=>
GEOS4 better

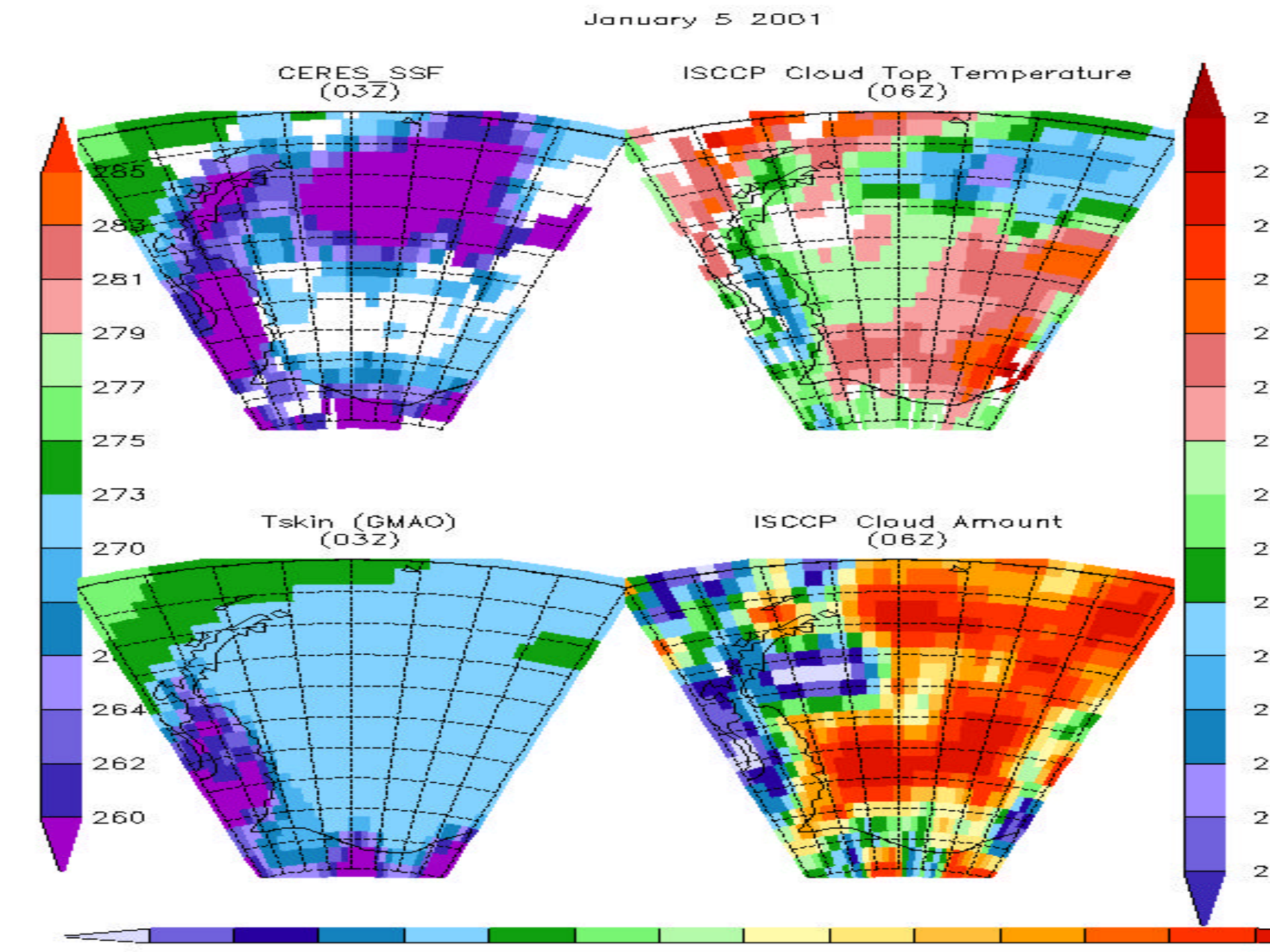


Tskin Differences and ISCCP Cloud January 2001



Tskin and Clouds for 300E_330E; 70S_60S Jan 2001




January 5 2001
CERES_SSF
(03Z)
ISCCP Cloud Top Temperature
(06Z)
285
283
281
279
277
275
273
Tskin (GMAO)
(03Z)
270
264
262
260
ISCCP Cloud Amount
(06Z)

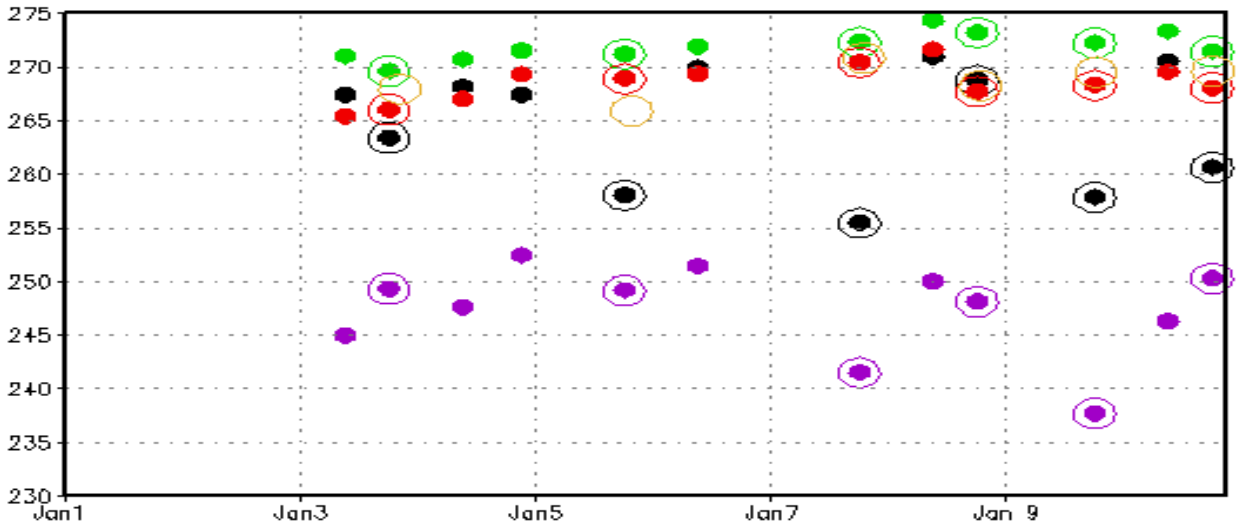
Tskin and Clouds for Central Eurasia – Jan 2001

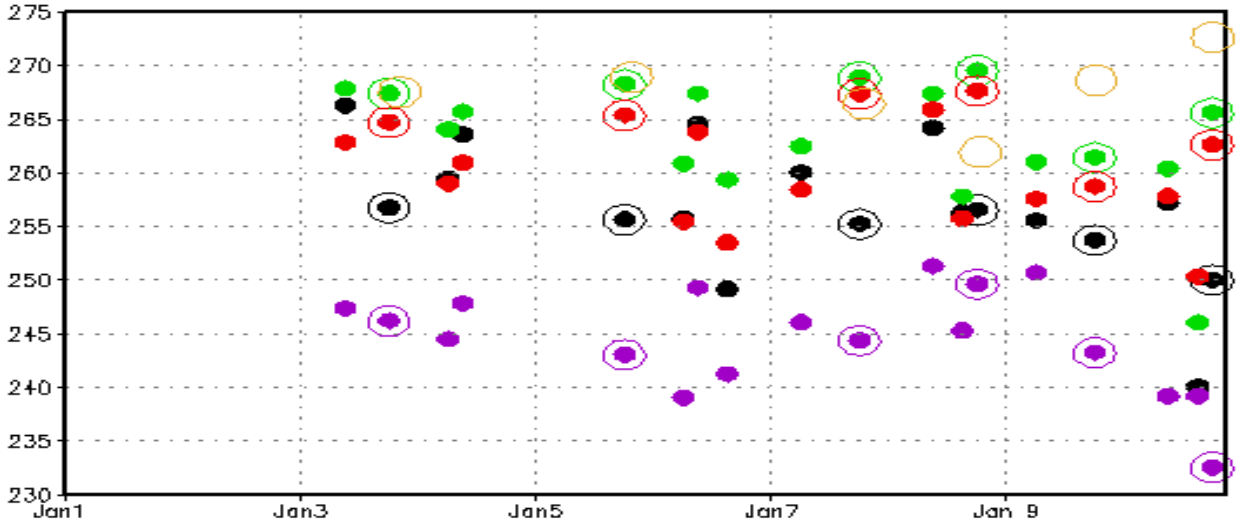
ECMWF

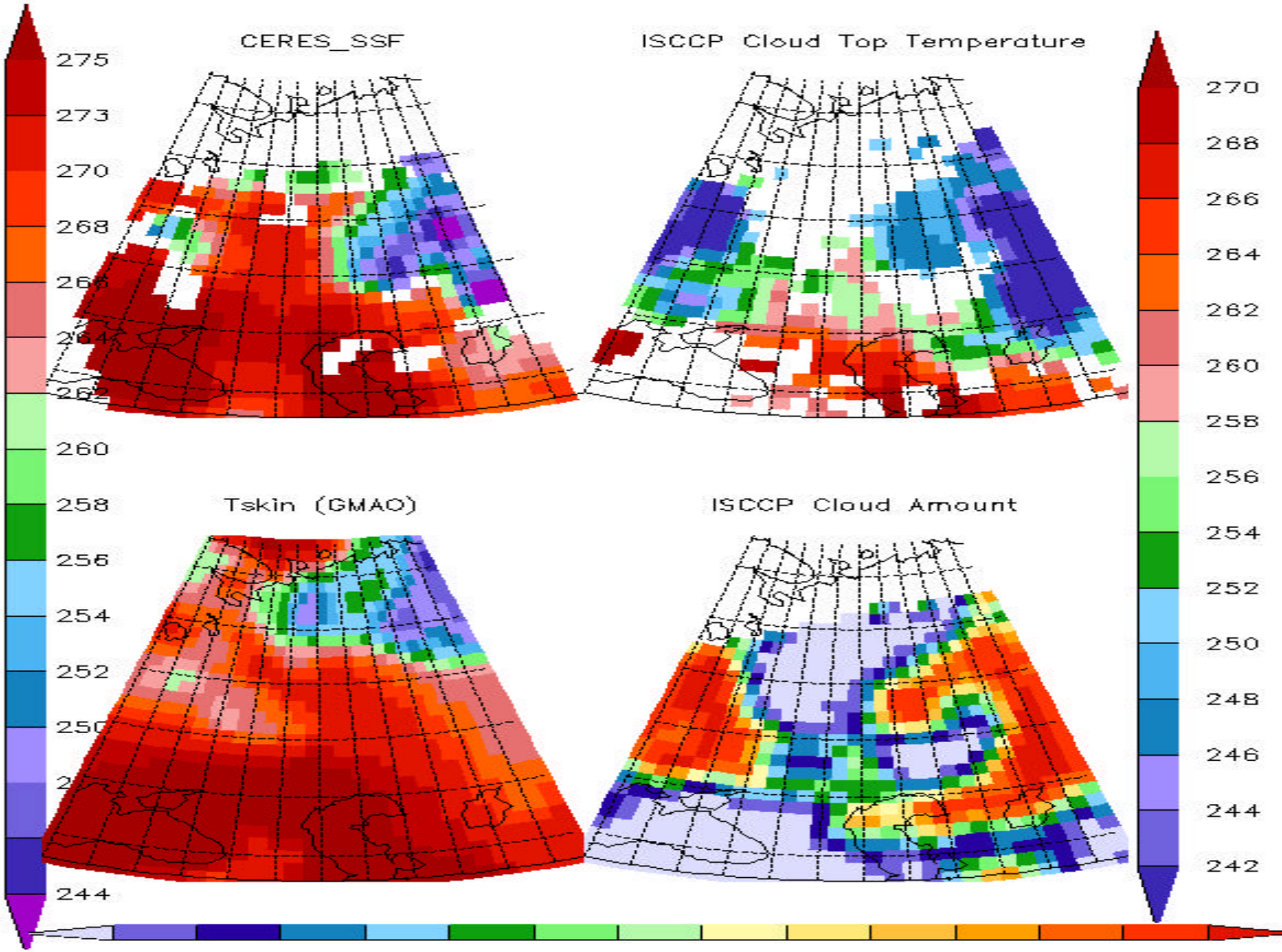
NEW GEOS4

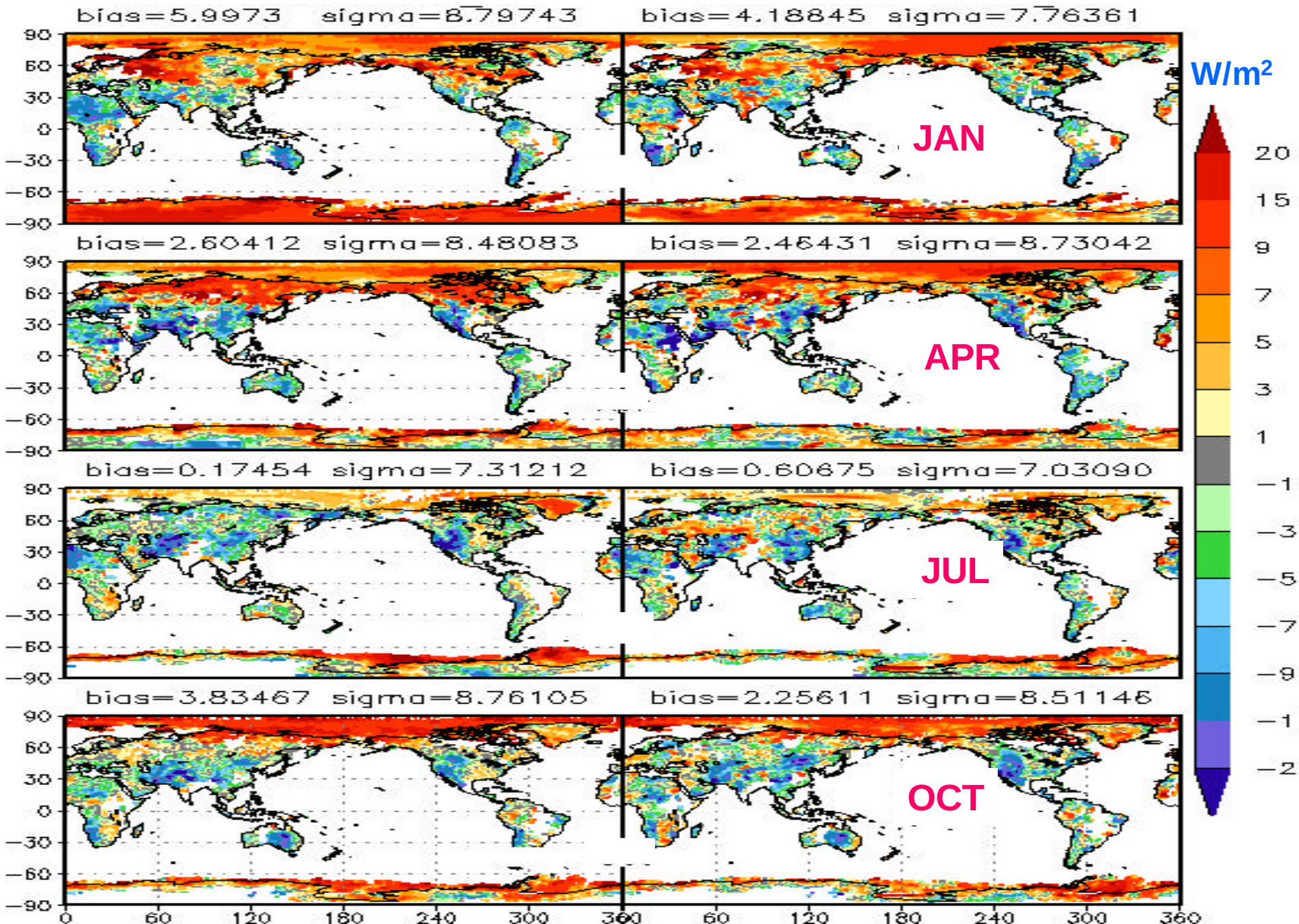
CERES

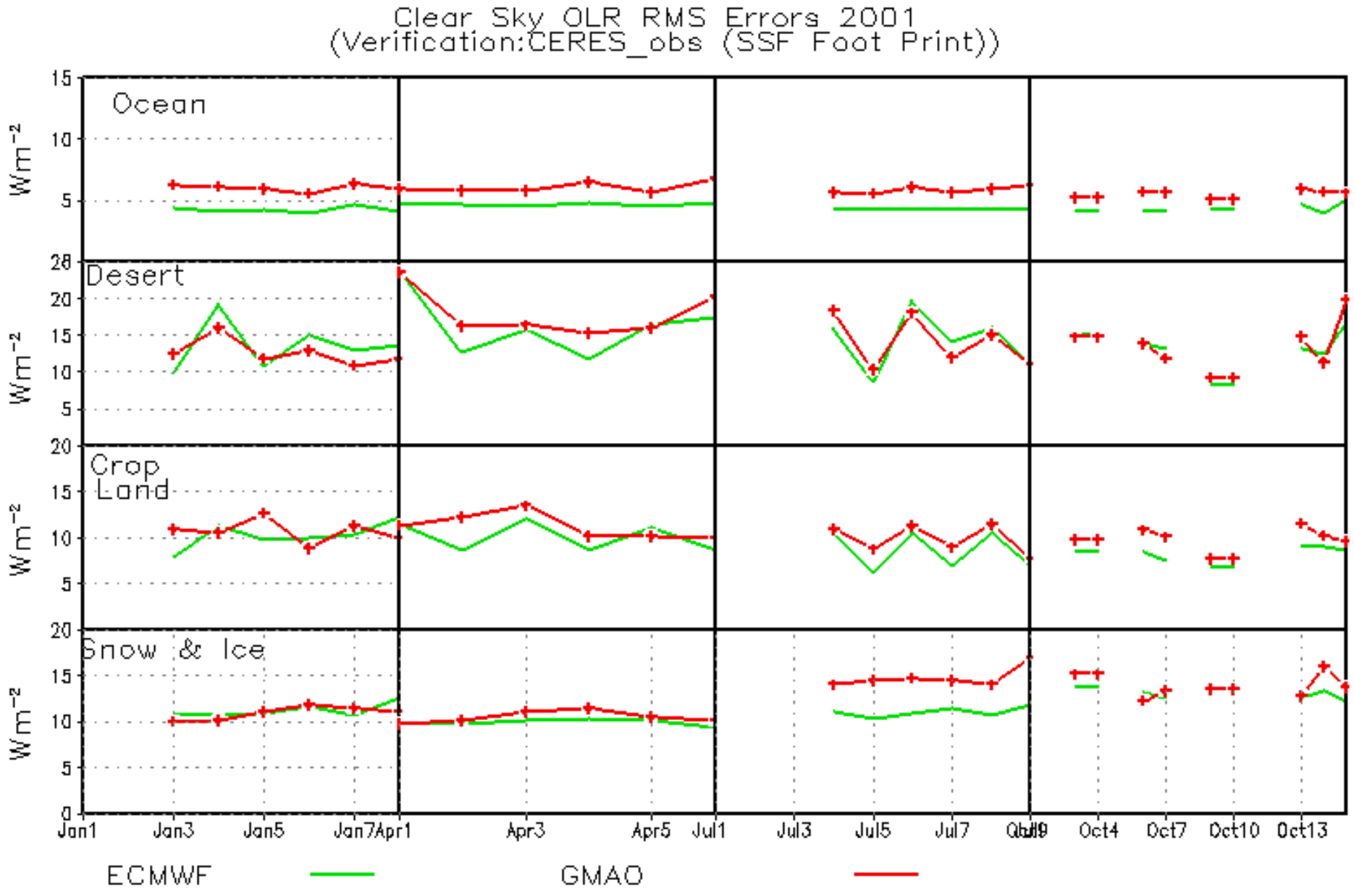
CLOUD TOP TEMPERATURE






Tskin and ISCCP Clouds at 18Z January 8 2001
CERES_SSF
ISCCP Cloud Top Temperature
Tskin (GMAO)
ISCCP Cloud Amount
275
273
270
268
260
258
256
254
252
250
244
270
268
266
264
262
260
258
256
254
252
250
248
246
244
242


ECMWF minus CERES
CLR 2001
NEW GEOS4 minus CERES
bias=5.9973 sigma=8.79743
bias=4.18845 sigma=7.76361
JAN
bias=2.60412 sigma=8.48083
bias=2.46431 sigma=8.73042
APR
bias=0.17454 sigma=7.31212
bias=0.60675 sigma=7.03090
JUL
bias=3.83467 sigma=8.76105
bias=2.25611 sigma=8.51146
OCT
W/m²
20
15
9
7
5
3
1
−1
−3
−5
−7
−9
−1
−2
90
60
30
0
−30
−60
−90
0
60
120
180
240
300
360


Clear Sky OLR RMS Errors 2001
(Verification:CERES_obs (SSF Foot Print))
Ocean
Desert
Crop Land
Snow & Ice
Wm-2
Jan1
Jan3
Jan5
Jan7
Apr1
Apr3
Apr5
Jul1
Jul3
Jul5
Jul7
Oct4
Oct7
Oct10
Oct13
ECMWF
GMAO

Summary

- **Problems:**
  CERES was concerned about earlier GEOS4 surface skin temperature (Tskin).

- **Tskin improvement:**
  GMAO Tskin is now comparable with ECMWF.
  - **New LSM, improved surface albedos.**
  - **Tskin analysis at 3hr intervals.**
  - **Smaller data window for surface TOVS.**

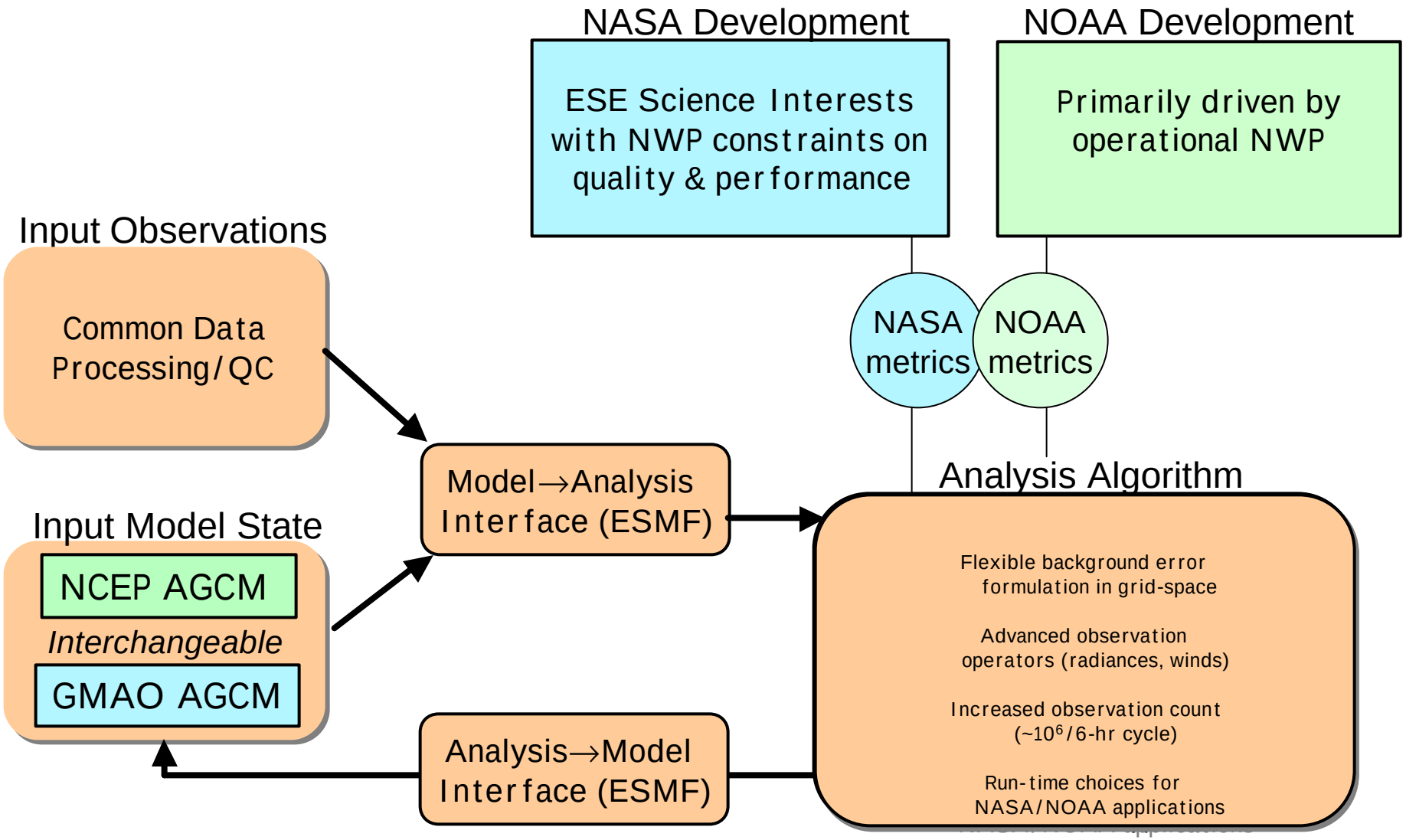
- **Clear-sky OLR Comparisons:**
  CLR also comparable to ECMWF
  - **ECMWF is better over ocean due to GEOS4 UTH problems**
  - **Over land statistics (bias, rms) are indistinguishable**

- **Common biases in ECMWF and GMAO suggest cloud clearing problems in retrievals.**

GMAO HAS FROZEN GEOS4 FOR CERES REPROCESSING

Next GMAO Assimilation system (GEOS5)

Joint Analysis System with NCEP - Accelerate the utilization and operational implementation of new satellite data types



- **Partnerships: developing a unified model for NASA**
- **Enabling Technology:**
  Earth System Modeling Framework (ESMF) Þ interchangeability